



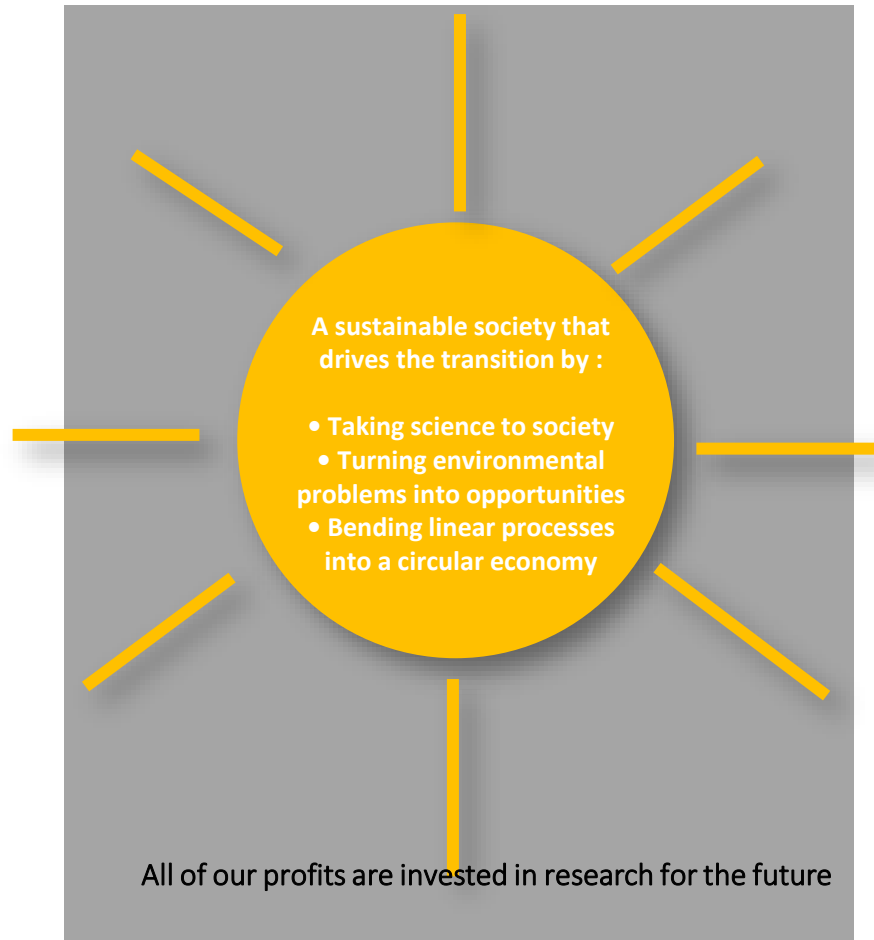
Green Circularity in a City context

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IVL Swedish Environmental Research Institute

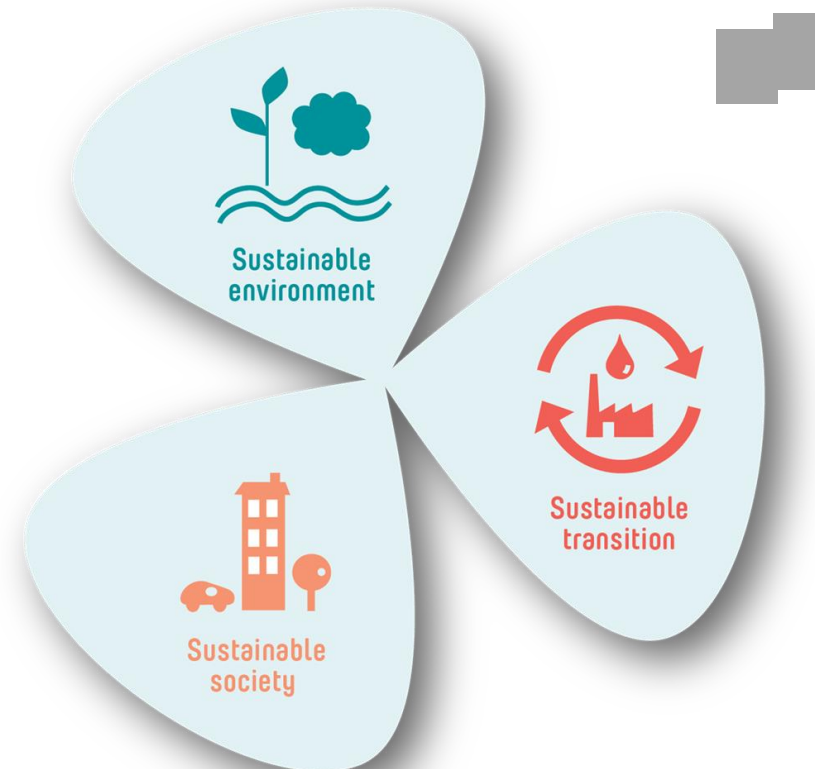


IVL Swedish Environmental Research Institute – the independent research institute

OUR VISION, A SUSTAINABLE SOCIETY:



WE WORK WITHIN THREE THEMATIC AREAS:



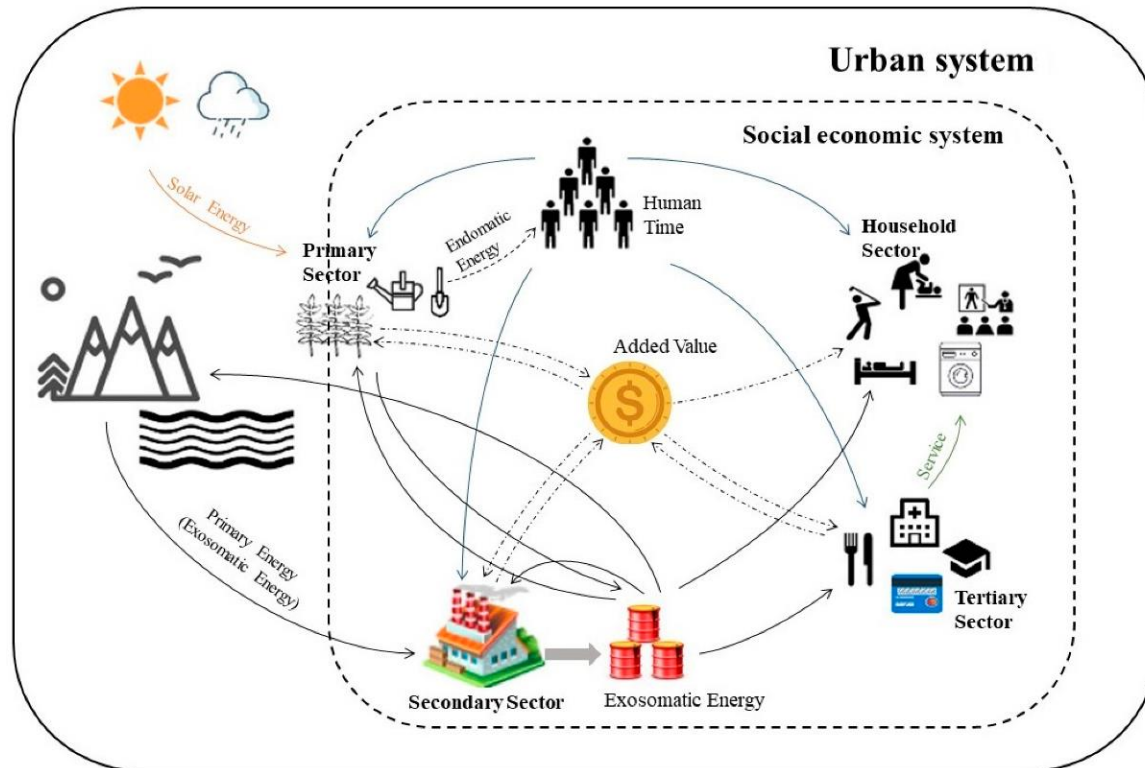
We conduct applied research and consulting projects in the environmental field

RECREATE: Resource nexus for transformation to circular, resilient, and liveable cities in the context of climate change

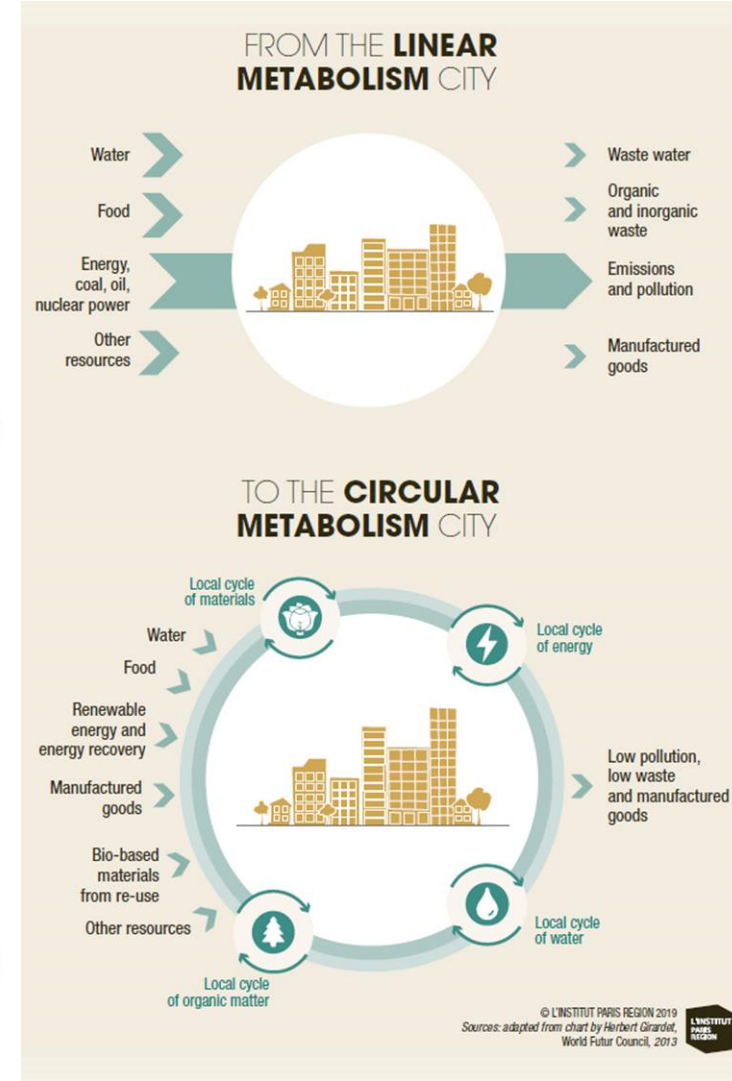
This project has received funding in the framework of the Joint Programming Initiative Urban Europe: Sustainable and Liveable Cities and Urban Areas, with support from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857160.



Socio-ecological system models: Urban metabolism



Wang et al. 2017. www.mdpi.com/2071-1050/9/8/1481



RECREATE

Resource nexus for transformation to circular, resilient, and liveable cities in the context of climate change

WP2 – Assess urban metabolism using network analysis

Collect city-level IO data

Energy and carbon associated flows

Network analysis of resources for 4 cities

Compare cities

WP3 – Resilience Index

Select variables and approaches

Collect data

Build index for 4 cities

Compare cities

WP4 – Policy exercise

Defining scope and stakeholders

Individual interviews

Group Exercise

Build on the results of the exercise



International Institute for Applied Systems Analysis



International Institute for Applied Systems Analysis

Methodology Input-Output Analysis

Sectoral carbon emission driven by final demand

$$e = b \times [I_m - A_m]^{-1} \times f$$

e : Environmental impact (i.e. CO₂ emission in this study)

b : CO₂ emission vector

I_m : Identity matrix

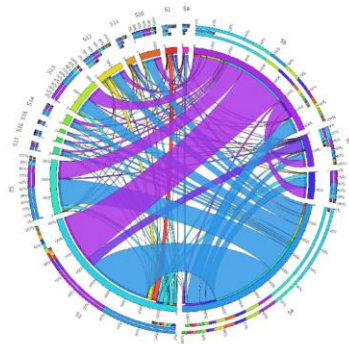
A_m : Intermediate coefficient matrix

$[I_m - A_m]^{-1}$: Leontief inverse

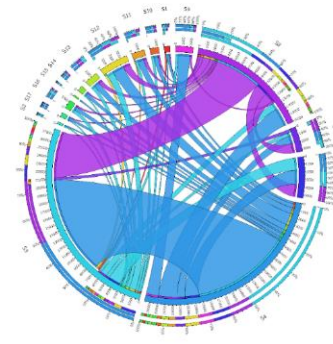
f : Final demand vector

Carbon Emission Flows among sectors (2017)

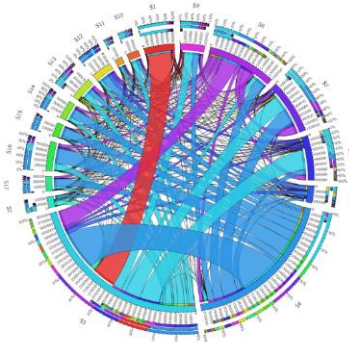
Network nodes are economic sectors, converted to energy, converted to carbon emissions



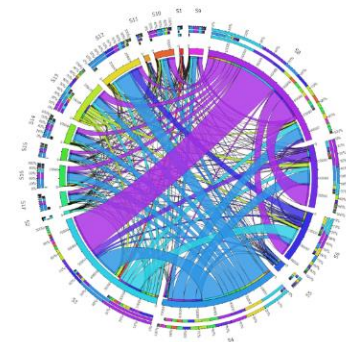
Beijing



Shanghai

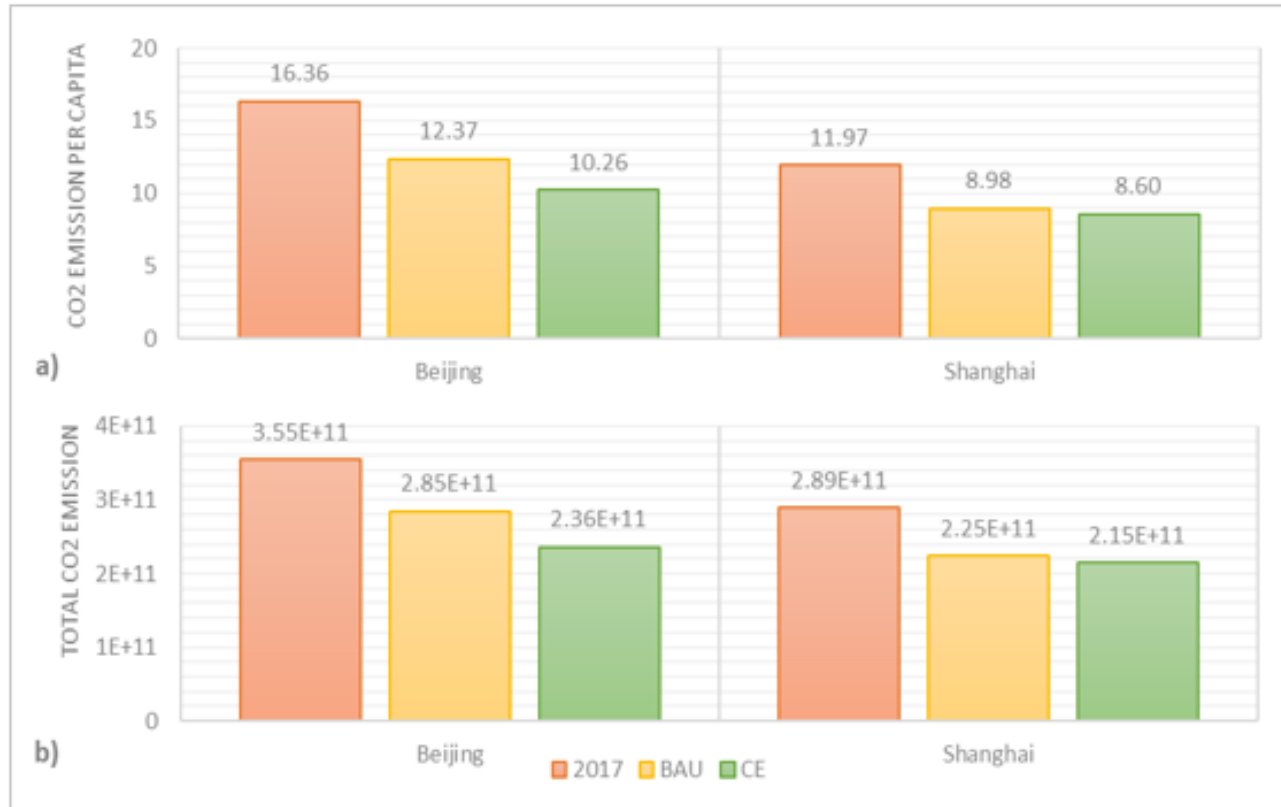


Vienna



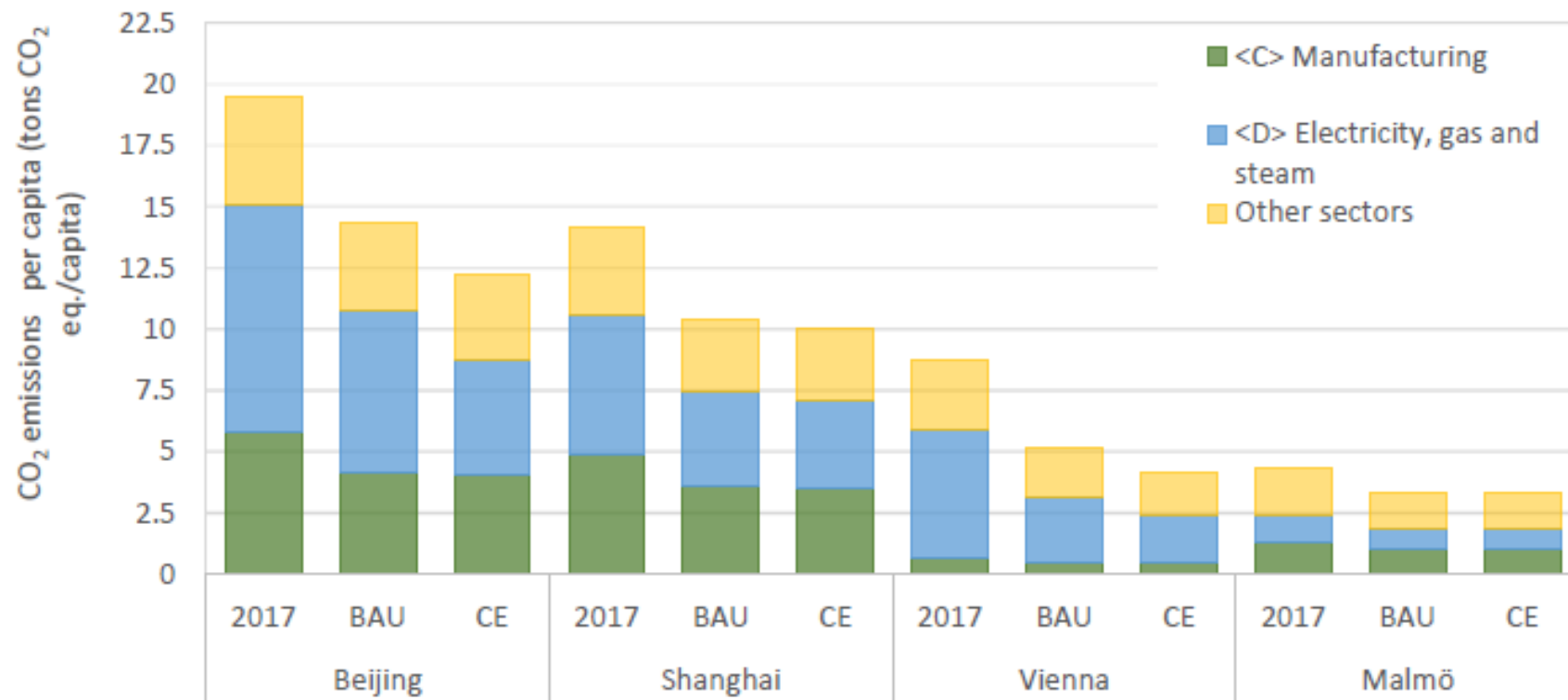
Malmo

Dominated by Manufacturing (S3), Transportation (S8), and Electricity production (S4)



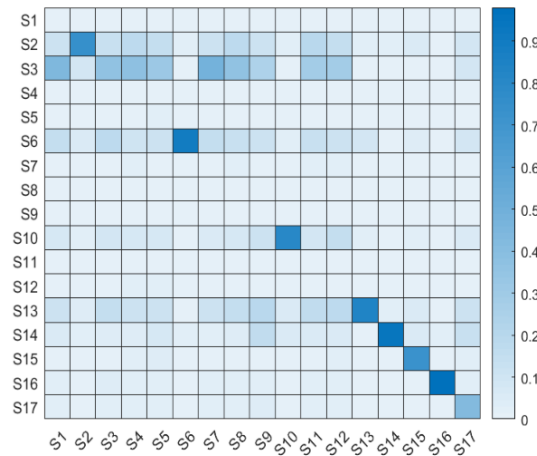
➤ Total CO₂ emission

1. Beijing has higher emissions than Shanghai
2. Progressive reduction in emissions from 2017 to BAU scenario to CE scenario
3. Compared with BAU scenario:
 - For Beijing, the emission of CE scenario reduces 2.11 tons CO₂ eq. per capita
 - For Shanghai, only 0.38 tons CO₂ eq. per capita is reduced

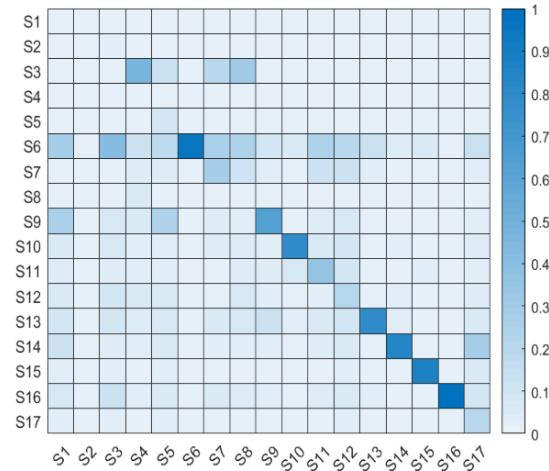


CO₂ emissions distribution by sectors in the case study cities for the different scenarios (tons CO₂ eq./capita).

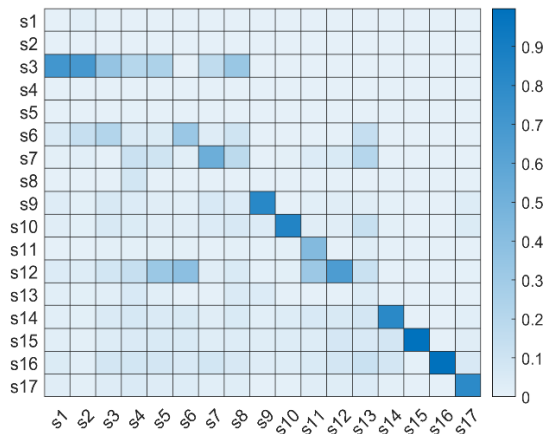
Control Analysis



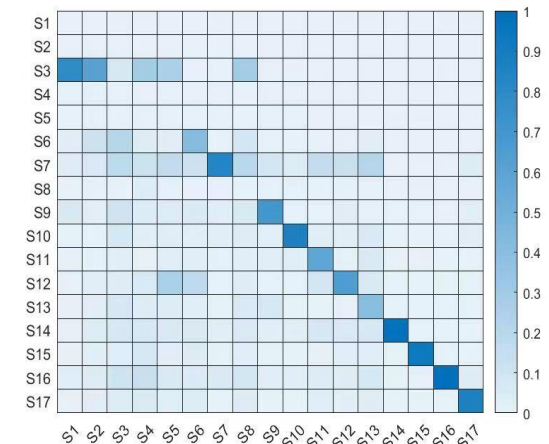
Beijing



Shanghai



Vienna



Malmo

S10, S13, S14, S15, S16 represent service-oriented, higher “trophic-level” sectors.

S2 self-loop is strong in Beijing and S6 is strong in both Chinese cities, larger role of construction in the fast-growing Asian mega-cities.

The European cities were higher in S17, revealing a higher activity of recreational services. In addition to the strong self-loops

Conclusions from urban metabolism

- Cities, obviously, depend on exogenous energy resources
- Energy efficiency improvements can help but more important is how the energy networks are formed and maintained.
- Seven EU Mission cities in Sweden were chosen as part of the 100 cities, important to know the emissions caused by the actions they take
- Cities will have to have some monitoring of emissions towards the goal, IO tables and our other work can help with that
- Can create pathways for cities based on this project



Climate impact estimation tool for early stage in planning and building process

Development projects 2020-2024 within Swedish Energy Agency research programme E2B2



Project 1: 2020-2022

Continuation project: 2022-2024

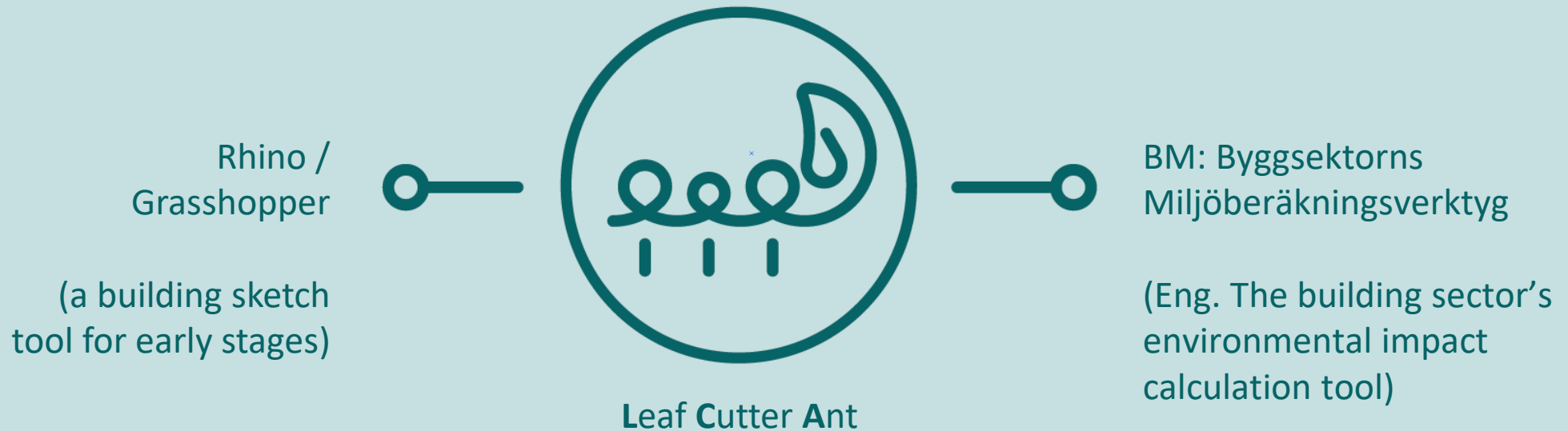
Focus:

How can we understand the buildings' climate footprint already from the first sketches?

Project partners: IVL Svenska Miljöinstitutet, FOJAB Arkitekter, Arkitektkontoret Warm in the Winter, RISE, Tyréns, Chalmers, MKB Fastighets, Byggnadsfirman Otto Magnusson

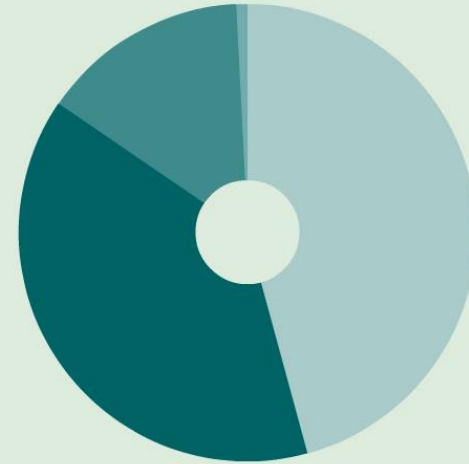
Design tools must get connected to climate calculation tools

Prototype pilot tool developed in 2020-2022



Simplified LCA climate estimates in "Leaf cutter ant".

Based on sketch of typical building elements connected to generic climate impact data.



20000
20000

Co₂e
Co₂e/👤



Bjälklag



Yttervägg

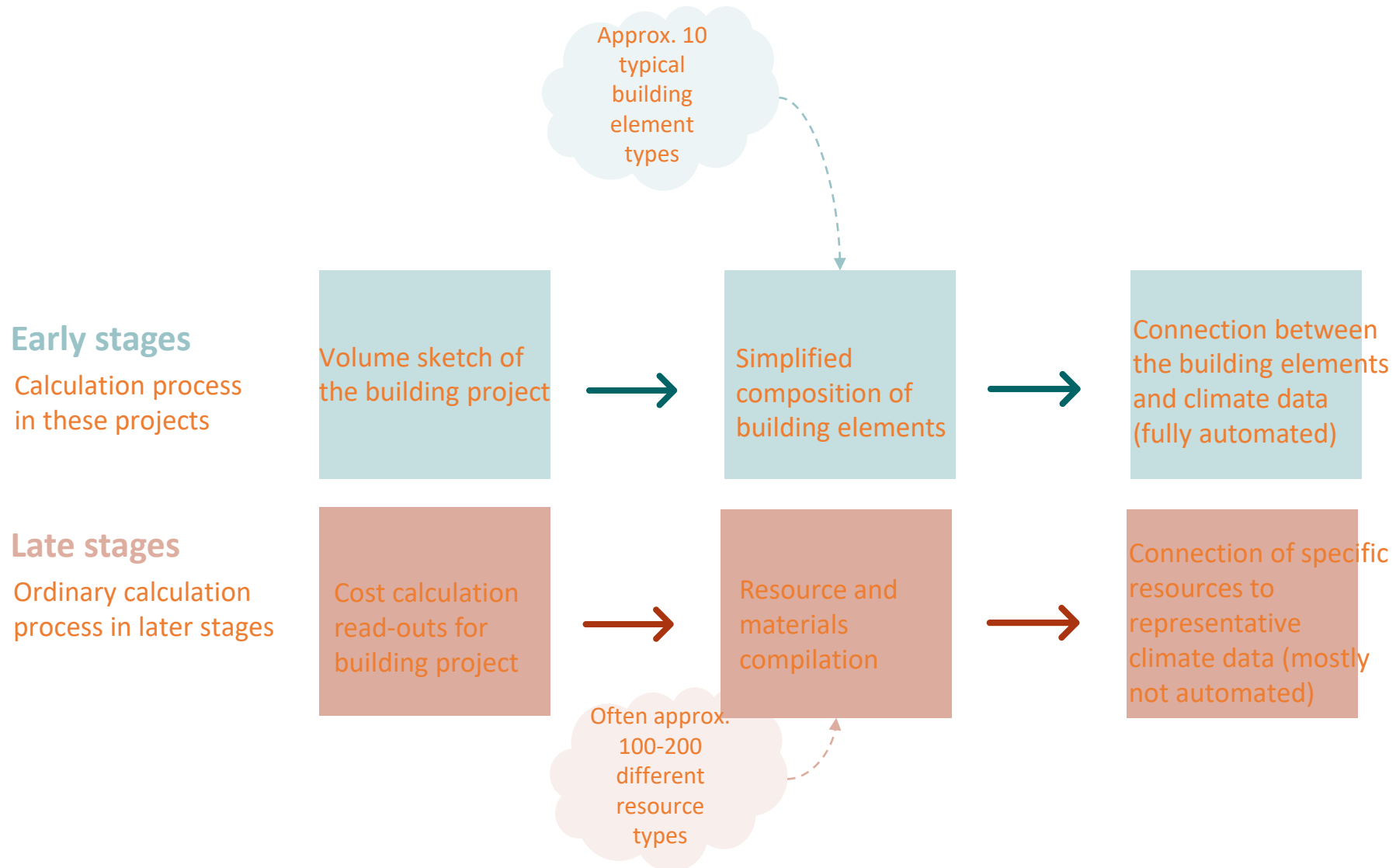


Fönster



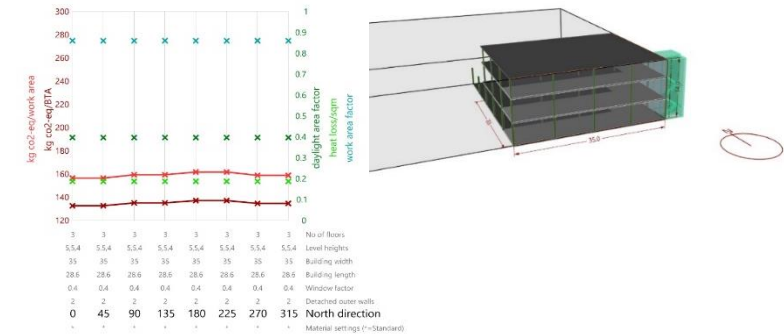
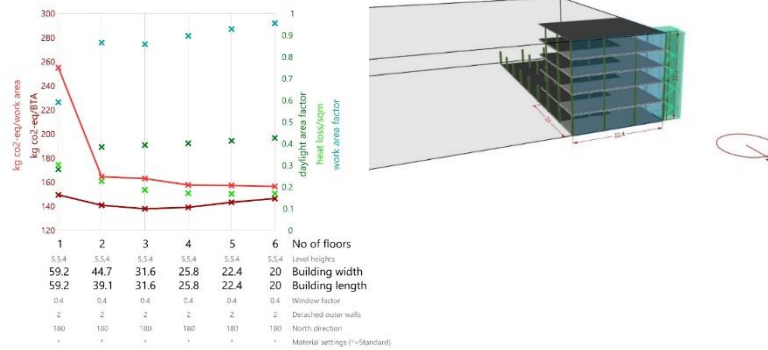
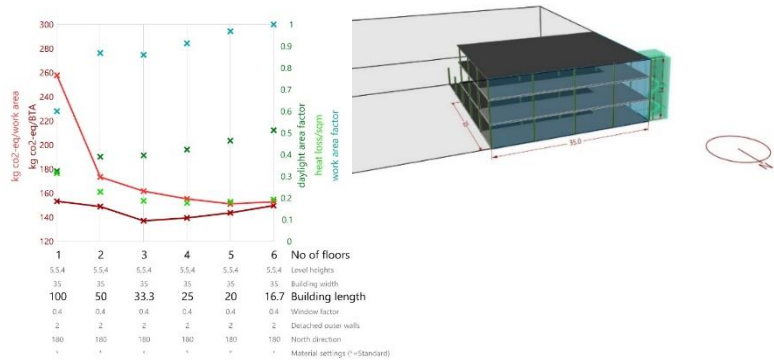
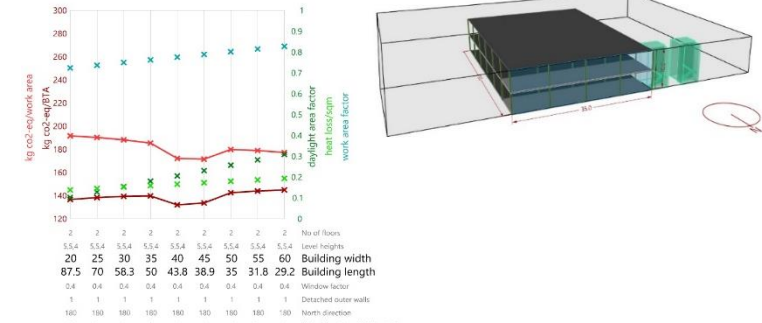
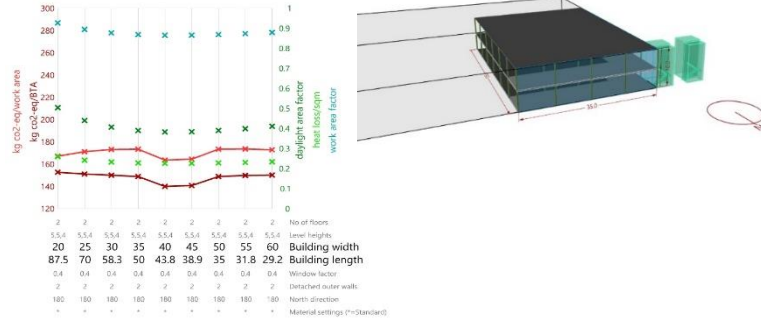
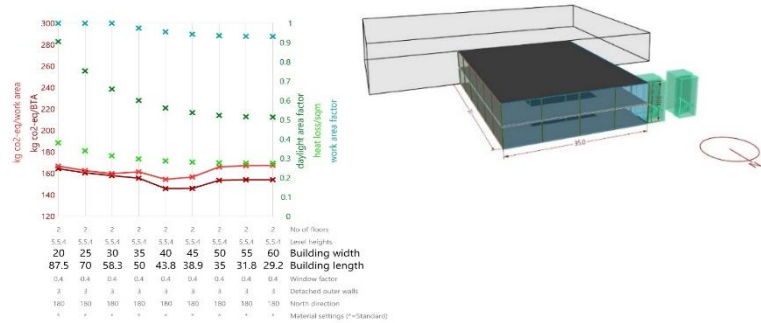
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Difference in data use and detail level depending on stage



A case study

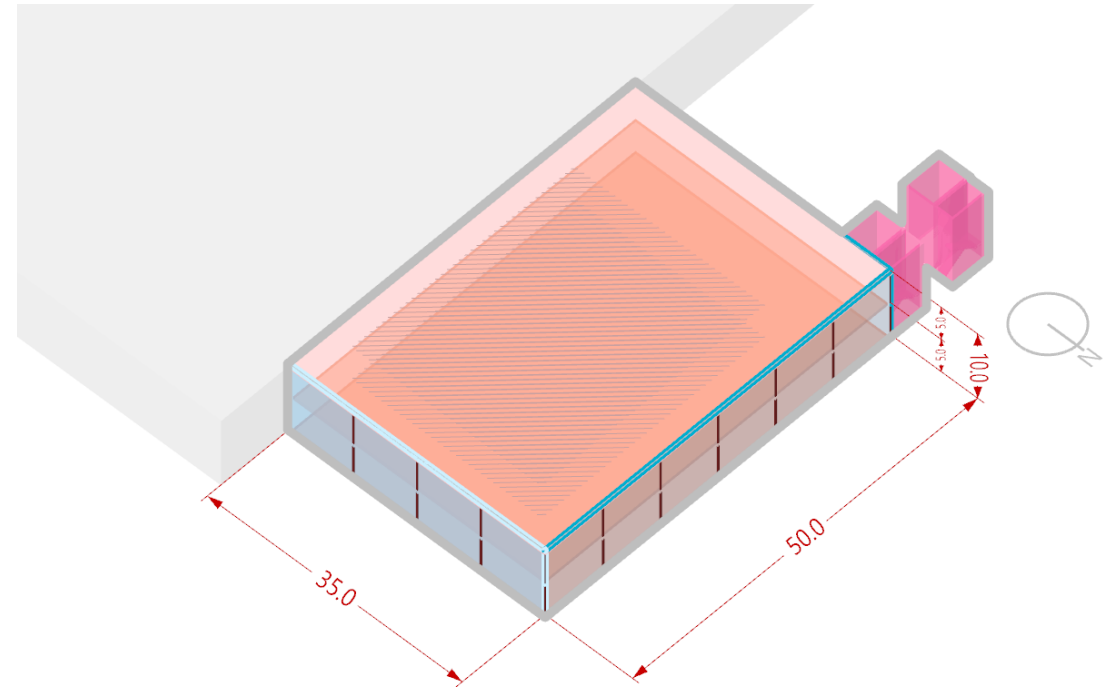
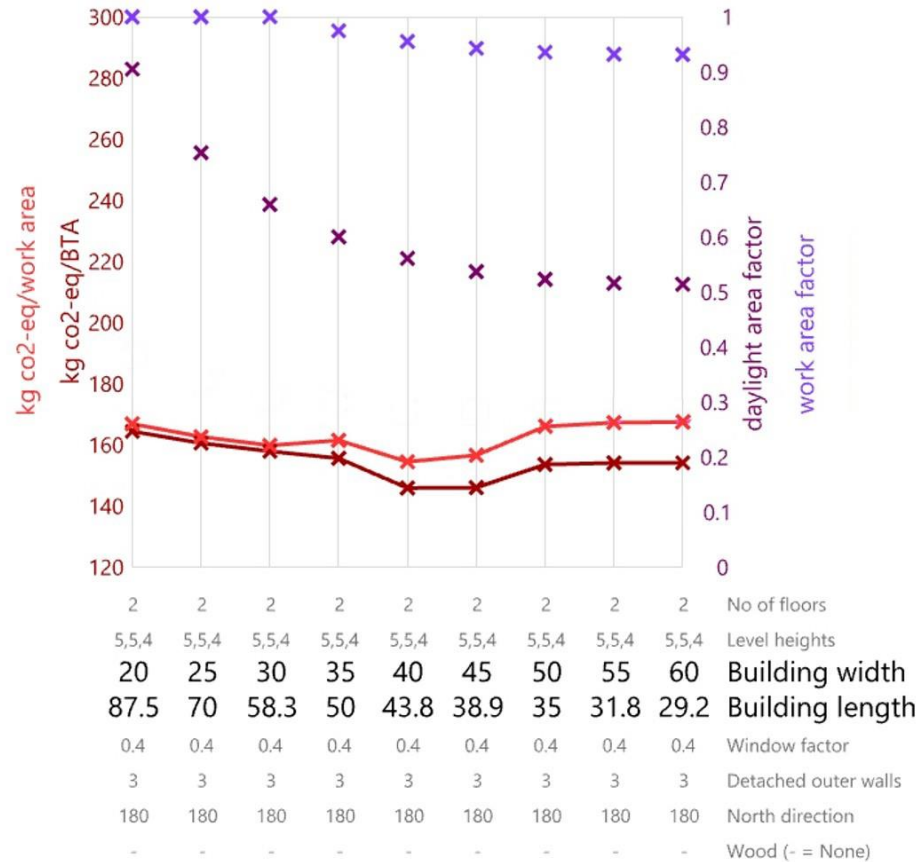
Iteration process – real time impact on result indicators when changing the geometry



A case study

Example from case study – office building

Possibility to optimize based on several result parameters



Further development:

New parameters being added in continuation project: Energy losses, price.

CCBuild



Centre for
**circular
construction**

Key barriers

- Lack of knowledge
- An immature market



Solutions

- “Learning by doing” – sharing insights
- Innovation projects
- Collaboration arena with digital platform:

CCBuild: a market driven initiative

Collaboration arena

Networking, working groups, experience exchange

Digital services

Product bank with reuse KPI:s, Inventory app,
Marketplace

Target groups:

Property owners, architects, consultants, public sector, contractors, material suppliers, local networks, research institutes etc



Centrum för
**CIRKULÄRT
BYGGANDE**

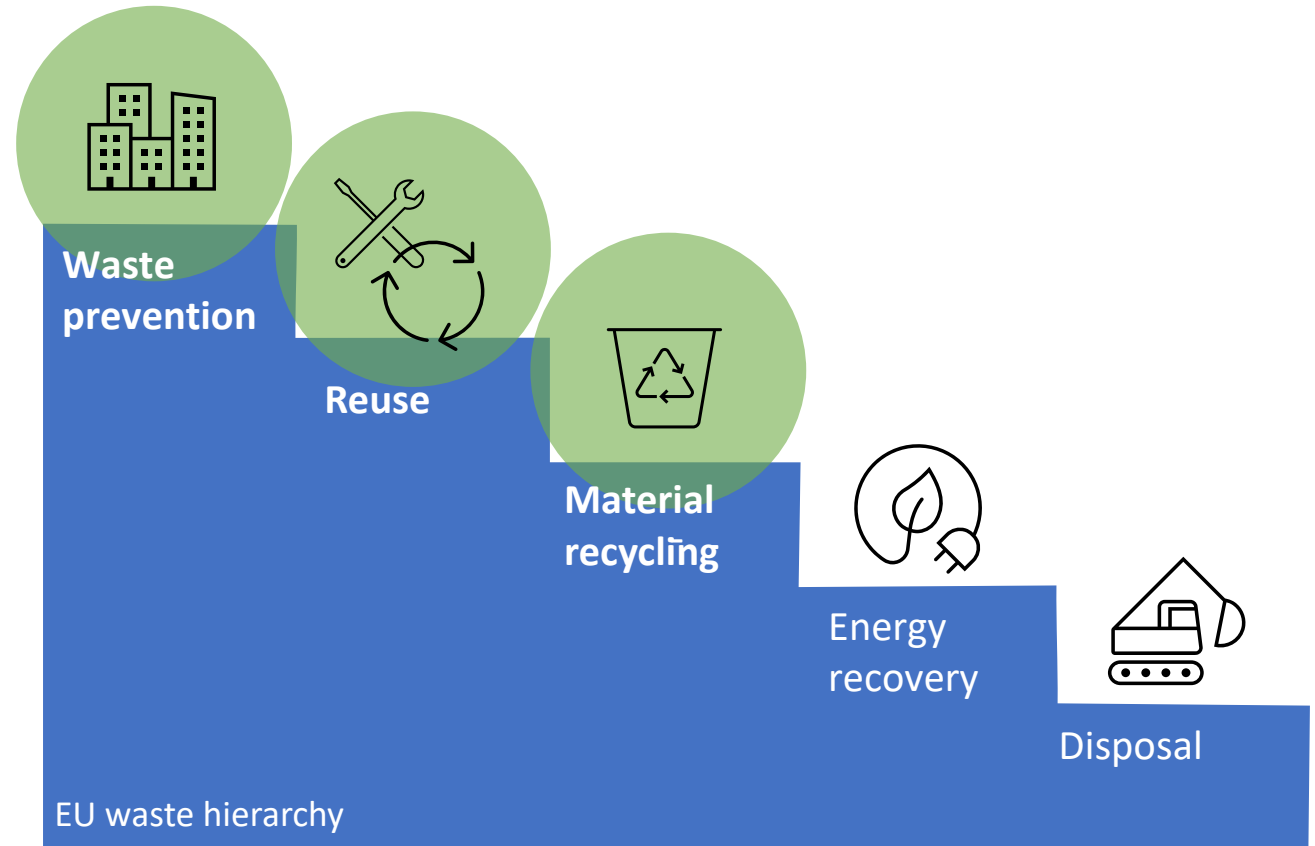
www.ccbuild.se

VINNOVA

CCBuild



- Collaboration arena
- Building knowledge
- Sharing experience
- Digital services



CCBuild product bank with value analysis

CO₂e saved
Potentially reduced
climate emissions



Economic value

kr

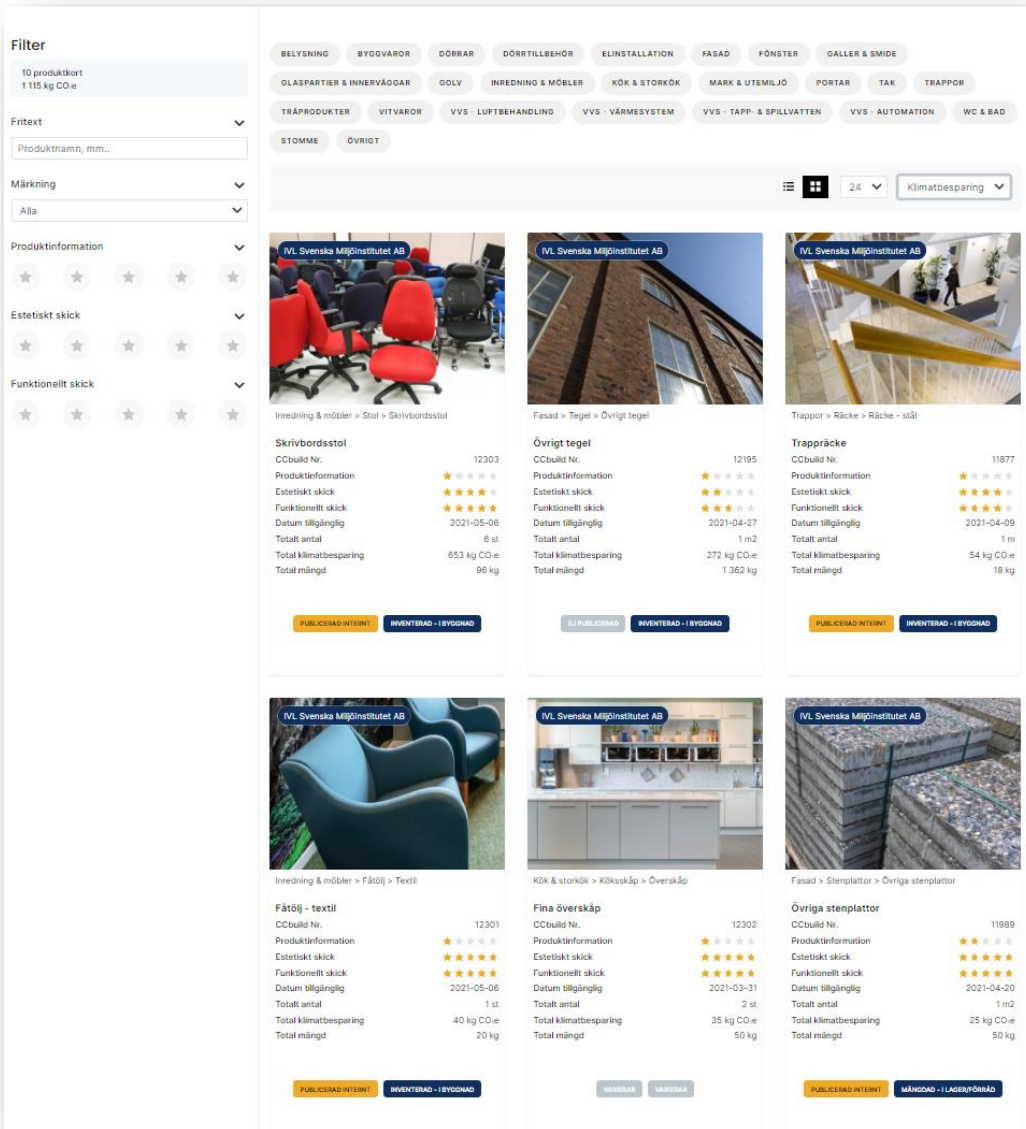


Weight
Reduced waste

ton



Method presented on CCBuild website (in Swedish) <https://ccbuild.se/hjalpsida>



The screenshot displays the CCBuild product bank interface. On the left, there is a 'Filter' sidebar with options for '10 produktkort 1115 kg CO₂e', 'Fritext', 'Märkning', and 'Produktinformation'. The main area shows a grid of product cards, each with a title, image, and detailed specifications. The products shown are:

- Skrivbordsstol** (Office chair): CCbuild Nr. 12303, 6 st, 653 kg CO₂e, 96 kg.
- Övrigt tegel** (Brick): CCbuild Nr. 12195, 1 m², 272 kg CO₂e, 1362 kg.
- Trappräcke** (Stair railing): CCbuild Nr. 11877, 1 m, 54 kg CO₂e, 18 kg.
- Fätölj - textil** (Textile): CCbuild Nr. 12301, 1 st, 40 kg CO₂e, 20 kg.
- Fina överskåp** (Cabinet): CCbuild Nr. 12302, 2 st, 35 kg CO₂e, 50 kg.
- Övriga stenplattor** (Stone slabs): CCbuild Nr. 11989, 1 m², 25 kg CO₂e, 50 kg.

CCBuild today



> 100 organisations

> 400 000 Products

Value:
€ 22 000 000

Återbruk av interiöra bygg
Utvärdering och arbetsg erfarenheter från IVL:s lo

Återbrukets Klimat effekter vid bygg
Handledning för klimatberäkningar i ei

Etablering av en marknad för återbygg- och fastighetssektorn
Återbruksrelaterade tjänst en storskalig återbruksmar Göteborgsregionen

Potential, effekter och erfarenheter från återbruk i bygg- och fastighetssektorn
- från den lokala samverkansaren i Göteborgsregionen "Återbruk Väst"

Carina Loh Lindholm, Hanna Gerhardsson, Lena Youhanan, J IVL Svenska Miljöinstitutet
Hanna Gerhardsson, Johanna Andersson, Åsa Thyryn
Marta Wernery, Hanna Gerhardsson, Sandra Möberg, Ca
Johanna Andersson, Sandra Möberg, Hanna Gerhardsson, Carina Loh Lindholm

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Samarbete med: STREVA
Samarbete med: Spiritum Arkitektur
Samarbete med: ETEUVA
Samarbete med: Business Region Göteborg, Chalmersfastigheter, Göteborgs Stad (Lokalförvaltningen, Fastighetskontoret), Akademiska Hus, Castellum, Klövern, Västfastigheter, Tengbom, White Arkitektur, UNK Arkitektur, Bengt Dalgren AB och Johanneberg Science Park

Referensprojekt

Här är en mängd goda exempel med fokus på återbruk och cirkularitet i bygg- och fastighetssektorn. Har du ett eget referensprojekt som du vill visa? Kontakta oss gärna på ccbuild@ivl.se.

Typ av uppdrag	Regioner	Cirkulära strategier	Cirkulära material	Projektstatus	Sortering
Välj	Välj	Välj	Välj	Välj	Organisation
Återbruket - Skytt Nybyggnad Accus					
Läs mer					
Cirkulärt skyltprogram i samverkan med Wihlborgs Ombyggnad Accus					
Läs mer					
KIKÅS - Återbruket - Skyttar Nybyggnad Accus					
Läs mer					
Historiska museet					
Solna station källsorteringsbyggnad					
Nya Handelshögskolan i Göteborg					



Ljusekulla - a projectidea

Together SKANSKA wanted to create the first Swedish climate positive neighbourhood with room for cultivation of tomorrow



SKANSKA